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ABSTRACT

A study was conducted to validate the welding curriculum materials developed and published by the Oklahoma State Department of Vocational and Technical Education. Twelve instructors collected achievement data (unit tests, assignment sheets, and evaluation forms) concerning the performance of 280 students on a total of 46 instructional units. Item analyses, including frequency counts of the number of correct answers and the percentage of students having a correct answer on a given item, were made for the tests and assignment sheets. The study identified those concepts which 20 percent or more of the students were not achieving. Data indicated that the manual should be revised to meet the needs of instructors and industry. Accurate illustrations or photos are also needed. In addition, short-answer questions should be replaced by multiple-choice type questions. More activities should be included to allow students to practice measuring and drawing objects. Finally, the curriculum specialist should determine whether all information included in the units is relevant to job skills being taught. Recommendations called for future studies to ascertain if visual aids, currently under development, will raise student achievement in the welding area. (Student test scores and teacher comments are included.) (MN)

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VALIDATION OF WELDING CURRICULUM MANUAL

Sheila D. Stone

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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ABSTRACT

This report is the result of a field test of Welding curriculum materials developed and published by the Curriculum and Instructional Materials Center, Oklahoma State Department of Vocational and Technical Education. The results and conclusions reported in the study relate to student achievement and teacher evaluation and comments for fifteen units of the manual.

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INTRODUCTION

The Curriculum and Instructional Materials Center (CIMC) at the Oklahoma State Department of Vocational and Technical Education is recognized nationwide as one of the leaders in curriculum development. The CIMC has developed a large number of curriculum manuals in the past decade. These manuals have been standardized in format and are used by curriculum centers and instructors throughout the United States and in several countries.

Because teachers need to have immediate access to good curriculum materials, the CIMC developmental processes have not included a field test of materials before they are released for sale to the schools. Advisory committees composed of vocational teachers, representatives from business and industry, teacher-educators, the curriculum specialist/writer, and state and district supervisors knowledgeable in the particular occupational areas are used extensively throughout the developmental cycle to ensure the validity of the content. Past experience and feedback from teachers have given validity to the format and to the usability of the materials by both students and teachers.

This is one of a series of studies conducted to determine validity in terms of student ability to attain the performance-based objectives of the curriculum. The purpose of this study was to validate the Welding curriculum manual.

DESIGN AND METHODOLOGY

Names of the Oklahoma welding instructors were obtained from the Trade and Industrial Division of the State Department of Vocational and Technical Education. In addition, names of purchasers of the Welding manual were obtained from the Curriculum and Instructional Materials Center. Letters were sent to these instructors requesting that they indicate which units of the Welding manual they planned to teach during the 1979-80 school year and the approximate dates the units would be taught. A copy of the table of contents was enclosed for their convenience in checking the units. Responses were tabulated to identify those units which would be taught early in the school year.

Of the thirty respondents who were telephoned to ascertain if they would participate in the field test, twenty-one instructors agreed to help. A letter was then sent to each instructor explaining the field test procedures and listing the units that particular instructor had been assigned to field test. The instructors were also encouraged to send other unit tests if desired.

Each instructor collected the student achievement data in the following manner. The performance-based test which accompanied each unit in the manual was administered by the instructor to each student upon completion of the unit. The tests were graded item by item; i.e., the teacher indicated on the student's tests whether each test item was answered correctly or incorrectly. The instructor was free to add or delete test items, weight the items for a total score, or use any other procedures normally used in testing. However, the Research Unit considered only the items on the unit tests. The student's performance on each assignment sheet and job sheet was also to be recorded on the unit test. The instructors were asked to send in selected assignment sheets for which performance could be measured; e.g., one assignment sheet could be used to measure the student's ability to correctly read a rule to the nearest one-sixteenth, one-fourth, and one-eighth inch.

Evaluation forms were provided so that the instructors could comment on the various components of the unit and on changes that needed to be made. Criticisms and suggestions were encouraged. Copies of the correspondence and unit evaluation form are included in the appendix.

As each unit was completed, the teacher submitted the unit test, assignment sheets, and evaluation form to the Research Unit. Data were keypunched and the tests and assignment sheets were returned to the teacher. Item analyses were made on the tests and assignment sheets. These analyses included frequency counts of the number of correct answers and the percentage of students having a correct answer on a

given item. The results were used to help identify those items which the students had difficulty achieving.

Nine of the twenty-two instructors who originally agreed to participate were unable to submit any tests. Four instructors said they would send their units at the end of the school year but did not. One instructor was hospitalized and the substitute teacher did not save the tests; another was also hospitalized but sent one set of tests at the first of the year. Another instructor did not save the unit tests because he thought the Research staff needed only the students' overall grades. One teacher quit teaching and two others gave no reason for their non-participation. The loss of these programs has obviously weakened the validity of the study.

TABLE 1

PARTICIPANTS IN THE STUDY

School Number	Number of Students	Number of Units Submitted
1	32	1
2	20	1
3	20	6
4	20	3
5	31	3
6	7	1
8	27	5
11	33	2
12	22	5
14	10	5
21	22	12
22	36	2

UNIT TEST RESULTS

Fifteen of the Welding units will be discussed in terms of student achievement. Unit tests were not available for "Parliamentary Procedure and Public Speaking". Teachers' comments on the fifteen units will be presented at the end of this section. The unit tests are broken down item by item in the appendix to show the percentage of correct responses. Forms showing student achievement on each item by school are available from the Oklahoma Research Coordinating Unit.

It was determined that 80 percent of the students should answer the item correctly to demonstrate acceptable achievement of the concept being measured. Those concepts which students had the most difficulty achieving will be examined in the discussion of each unit. It is beyond the scope of the study to identify the reasons why students fail to achieve on a given concept.

Safety

Overall achievement was 85.4 percent. Correct responses ranged from 27.5 to 51.6 percent when the students were asked to match types of fire extinguishers to the class of fires they are best suited to extinguish. More than one answer was required for three of the items to be counted correct. This might have accounted for the lower response rate except that only 44.0 percent responded correctly on a fourth type of fire which should be extinguished by only one type of fire extinguisher. When matching the colors of the safety color code to their designations, less than 42 percent knew that yellow designated that caution should be used against starting equipment while it was being repaired or against the use of defective equipment. Less than 55 percent knew that black and white designated traffic flow. Both answers were required for the item to be considered correct.

This unit elicited the second highest overall achievement; however, because this is a safety unit, the acceptable achievement rate should be higher to help prevent injuries. The student safety pledge code was signed at three of the four shcools. There was no response from the fourth instructor.

Orientation to Welding

Overall achievement at the participating school was 83.7 percent. The 80 percent standard was not achieved on any of the terms and definitions. The students were not required to name demand potential in Oklahoma for specific welding processes. The answers given in the curriculum manual are probably outdated. This type of question might be better suited as a suggested activity for the instructor. Current

information could be obtained from the VIEW division at the Oklahoma State Department of Vocational and Technical Education, OTIS, and/or the Occupational Outlook Handbook. Because vocational education strives to meet the needs of business and industry, the skills being taught should be tied to the high and average demand occupations.

The students confused mig and tig welding. They also had trouble naming two items to consider in choosing a career. There was no response whether the students obtained a social security card and completed a personal information sheet as stated in the assignment sheets.

Metals

The students averaged 76.4 percent overall. A range of 56.7 to 73.1 percent was obtained when the students defined six terms associated with metals. Three of the terms -- metal, ductile, and weldability-- were missed by many students in all three of the schools. Two of the classes fell considerably below 60 percent when identifying the parts of the SAE/AISI numbering system for metals. These same students had problems listing four methods used for metal identification. Classifying metals as ferrous and nonferrous confused students at the three schools but the only metal which elicited responses of less than 80 percent (56.7) at all three schools was nickel-wrought. The confusion may have resulted because nickel is a nonferrous metal, but nickel wrought iron is a ferrous metal.

It would appear that the majority of students at two of the schools could not answer discussion questions or those requiring a list of answers. Discussing the importance of metallurgy was not required of the students by one instructor and was answered incorrectly by one-half of the students at the other two schools. Two of the instructors did not ask their students to describe the difference between low alloy, high tensile steels and low carbon steels. Discussing the properties of metals elicited an overall response rate of 65.3 percent but it was caused by the low achievement rate (20.0) at one school; another instructor did not use the question. This also occurred when the students discussed major conditions that cause aluminum to be difficult to weld. Two classes had trouble listing five advantages of using aluminum in welding; all three of the classes fell below the 80 percent standard on the fifth advantage. Two instructors did not respond about the use of the assignment sheet; 46.4 percent of the students at a third school could write a metal analysis from given tables.

VICA

The overall achievement for the one school submitting the unit tests was 76.4 percent. The students could name four of the five purposes of the VICA organization. The students were asked to write the VICA motto and pledge on the unit test. On the instructor's evaluation form, he wrote that the students recited the motto and pledge because of their poor writing abilities. If most students had answers on the test questions, the items were counted incorrect for those students who did

not attempt it at all. These students might have been able to recite the motto and pledge but were not given credit on the test because the instructor had not marked it correct. Five out of six symbols on the VICA emblems were missed by one-third to one-fourth of the students. This low achievement could have resulted from the requirement that both the symbol and its meaning had to be correct before the item was counted as correct.

Becoming a Good Leader

Overall achievement was 77.6 percent. Less than one-half of the students could define leadership. The students were able to list three of five characteristics of a good leader and two of five values of having leadership ability. They could list only one of the four steps to becoming a leader. There was no response as to whether the assignment sheets were used. The unit test was composed entirely of short answer and discussion questions.

Applying for a Job

The highest overall achievement (91.7 percent) was obtained on this unit. As a whole, the students were able to list only one of five means of locating job openings. The other items that fell below the 80 percent level were a result of low achievement in the individual schools. There was no response from two instructors about their use of the assignment sheets. Of the students completing the assignments at a third school, 76.9 percent could satisfactorily write a letter of application and only 62.5 percent could complete an application form. Achievement on the other assignments was above 89.5 percent.

Measuring

Achievement fell slightly below the 80 percent standard (79.4 percent). Three terms-- modular, dimension, and fraction--caused some difficulty in at least three of the schools. A range of 39.5 to 77.6 percent was obtained when the students measured objects to the nearest one-sixteenth of an inch. A range of 53.9 to 73.7 percent resulted when the students drew objects to specified dimensions. One instructor did not use these two questions.

Of the two classes returning Assignment Sheet #1--Reading a Rule, only one fell below the 80 percent standard on any item. The low achievement occurred on reading the rule to the nearest sixteenth of an inch. The students were able to read it correctly when it was in inches, but when the foot mark was added they left it off in their answer. This situation also happened on the test. The same two schools responded on Assignment Sheet #2--Measuring Objects. One school fell below 80 percent on one-half of the items, but especially when measuring the height and slope of an object. The second school's students averaged 80 percent on those specific items, which was lower than that achieved on the remaining items. Three instructors returned Assignment Sheet #3--Drawing Lines and Objects. Drawing a line measuring 5/4 inch caused some confusion. When the students converted it to sixteenths,

they may have incorrectly assumed it was 10/16 inch rather than 1 4/16 inches. Drawing a rectangle and a triangle to specified dimensions resulted in achievement of 56.3 percent and 61.0 percent. Obviously, the students with the highest overall test scores also did better on the assignment sheets. It would therefore be advantageous to spend more time learning to read a rule, which is the basic skill needed before the student can accurately measure and/or draw objects.

Basic Blueprint Reading

Overall achievement was 71.5 percent. Only one term, blueprint, elicited correct responses of 80 percent or above. The response rate on the others ranged from 41.0 to 67.2 percent. The students encountered some difficulty in identifying the six views of a blueprint. Only one-third of the students could name any of the three dimensions to look for on a blueprint. Approximately one-half of them could name any one of the three basic elements of a blueprint. Except for the hidden line, none of the lines used in a blueprint were identified by more than 64 percent of the students. The only abbreviation that caused a problem was Br# which is used to identify brass, SAE#. Bronze, SAE# was also a possible choice and apparently was chosen incorrectly by over one-third of the students. A range of 16.4 to 23.0 percent was achieved when the students attempted to identify basic types of dimensions found on a blueprint. Less than two-thirds could draw a simple rectangular block to the correct dimensions. Only one out of the five students who returned Assignment Sheet #2 could correctly draw the rectangular block as specified in item one. Three students could draw a rectangular block as specified in the second item. The two items which averaged in the 60 percent range both dealt with the front view of different objects. It would appear from the test questions and the assignment sheets that the students need more practice in distinguishing the different views of an object. They also need practice drawing three-dimensional objects to specifications.

Oxyacetylene Cutting

Overall achievement was 67.4 percent. Defining flame cutting, drag line, kerf, oxide, and oxidizing proved difficult at each of the three participating schools. They also confused the oxygen fitting and torch valve with the acetylene fitting and torch valve and the preheat orifice with the cutting orifice when identifying the parts of the torch body and cutting attachment. As usually happens with list questions, the students were able to answer only two or three of the reasons for poor cuts or causes of a backfire. None of the classes scored above 80 percent when asked to list in the proper order the steps to follow in case of a flashback. Obviously, if one step is out of order some others will be also. However, since the safety of the welder and others in the vicinity depends on proper handling of the equipment, it is imperative that the students know the correct procedure. Students at two of the schools performed the job sheets to the satisfaction of their instructors; there was no response from the third school.

Oxyacetylene Fusion Welding

Overall achievement was 81.3 percent. The most difficult question for most of the students dealt with naming five factors that determine fusion weld quality. Four of the five schools fell below the 80 percent level on all five, with overall scores ranging from 49.5 to 61.9 percent. The students also had difficulty listing five properties of a good weld, naming two factors that determine tip size, and listing two factors that determine the type of filler rod to use. This test was composed entirely of short-answer questions. It would appear from the data that students at two or three of the schools were not as proficient in answering these types of question as they would have been in answering multiple-choice or matching questions. Three instructors reported their students completed the job sheets satisfactorily; there was no response from two other instructors.

Oxyacetylene Braze Welding

This unit ranked lowest in overall achievement with 49.9 percent. It was the shortest unit test. However, it was composed of short-answer type questions and only four of the twenty-eight test items were achieved above the 80 percent level. A mere 14 percent of the students could list only one or two characteristics of elements found in filler rods used in braze welding. Although the achievement was somewhat higher on the other items, it still fell considerably below the 80 percent standard. Students at two of the schools performed the job sheet to their instructors' satisfaction. They also made at least 5 percent more on the test overall than the school from which there was no response concerning the job sheet. It would appear that the students either did not need the information in the information sheets to braze weld a square groove butt joint or they could apply the concepts but were unable to express the answers in written form on the test itself.

Shielded Metal Arc Welding

Overall achievement was 74.5 percent. Three terms caused some difficulty-- whipping, weld metal, and weaving. The students had problems selecting factors that determine polarity. In most instances, the students did better with matching and select-from-a-list questions than with short-answer and discussion questions. One exception was the matching of lens shade numbers to types of welding operations. This question elicited responses ranging from 51.8 to 79.5 percent. Two-thirds of the students could name common types and sizes of electrodes and identify what the numbers on an electrode mean. Approximately 55 percent of the students could identify the parts of groove and fillet welds illustrated on the test. Two-thirds could identify types of welding joints. When identifying the parts of the welding process as illustrated on the test, students were most confused by penetration and heat lines. Students at three of the schools performed the job sheets satisfactorily; there was no response at a fourth school.

Shielded Metal Arc Welding: Position Welding

Overall achievement was 80.8 percent. In the majority of instances, the low achievement resulted from averages at one school. It is therefore assumed that the problem is unique to that situation. Students at two schools did incorrectly select "prevents better fusion of beads" as a reason for removing slag when it should have been to permit better fusion. More than likely the students overlooked that one word. They also could not name four factors that determine weld quality. The students did not know what caused arc blow but could name ways to prevent it. They also had trouble identifying two improperly formed beads by telling what caused them--the voltage was too low on one and the speed was too slow on the other. The clarity of the illustrations may have been a determining factor. One instructor did not respond about the use of the job sheets. One class completed eleven of them satisfactorily and were to do the other three later in the year Students at a third school did eight of the job sheets satisfactorily; there was no response on the rest.

Gas Tungsten Arc Welding

Overall achievement was 57.7 percent, with this unit ranking fourteenth out of the fifteen units. High frequency current and gas cup were the terms that caused the most problems. The students had trouble identifying the major controls of the GTAW power supply illustrated on the test. Less than 19 percent of the students could name the color, finish, sizes, and applications when given the type of electrode. In grading this particular question, all four answers had to be correct before the item was counted as correct. This in itself would cause a lower achievement rate than if the student had been given partial credit. Responses ranged from 16.7 to 46.5 percent when the students listed characteristics of argon and helium shielding gases. The students averaged 23.3 to 62.8 percent when matching the illustrations of poor welds with the causes of each. The welds that are shown on the test were the same ones used in the shielded metal arc welding unit and did not correspond with those shown on the transparency. This test question needs revision. None of the instructors responded as to whether the job sheets were used.

Gas Metal Arc Welding

Overall achievement was 60.2 percent. Only three terms were known by 80 percent or more of the students. There were sixteen terms to choose from and the list of definitions covered two pages. If the terms had been limited to only those definitions contained on the same page, the students might have scored higher. It was difficult for the students to identify the volt meter, amp meter, and wire feed control system when given an illustration. Matching shielding gases to their uses resulted in responses of 26.5 to 49.0 percent. Matching poor welds to the causes created problems for many students, perhaps because of the poor quality of the pictures. It might have been difficult for the students to determine what was wrong with the welds. Only 20.4 percent of the students could describe the effects of electrode wire stick out

on volts and amps. The format of the test question itself may have confused the students. There was no response from two instructors concerning the use of the job sheets. A third instructor did not use eleven of the job sheets in the class; the students performed the skills satisfactorily on the remaining ten.

Summary of Overall Achievement

Table 2 displays the percentages of correct answers on the unit tests by unit, by school, and by total across schools. The total for all schools indicates that on ten of the fifteen units, students failed to reach the arbitrarily set 80 percent level. This analysis is useful in the total evaluation of the curriculum manual as a whole; however, it fails to take into account the concepts being learned--how important they were in relation to the performance, how difficult they were to grasp.

TABLE 2
PERCENT CORRECT BY UNIT BY SCHOOL

UNIT	All Schools	School 1	School 2	School 3	School 4	School 5	School 6
I-A	85.4	-	-	-	-	82.7	-
II-A	83.7	-	-	-	-	-	-
III-A	76.4*	-	-	66.7*	-	88.0	-
I-B	76.4*	-	-	-	-	76.4*	-
III-B	77.6*	-	-	77.6*	-	-	-
IV-B	91.7	93.3	-	90.2	-	-	-
V-B	79.4*	-	-	85.4	-	-	-
I-C	71.5*	-	74.9*	-	-	-	-
I-D	67.4*	-	-	-	-	-	-
II-D	81.3	-	-	-	91.0	-	-
III-D	49.9*	-	-	-	-	-	-
I-E	74.5*	-	-	-	86.9	-	-
II-E	80.8	-	-	-	87.3	-	-
I-F	57.7*	-	-	62.0*	-	-	65.7*
II-F	60.2*	-	-	62.7*	-	-	-

Table 2, Percent Correct by Unit by School (Continued)

UNIT	All Schools	School 8	School 11	School 12	School 14	School 21	School 22
I-A	85.4	91.9	87.0	-	-	75.4*	-
II-A	83.7	-	-	-	-	83.7	-
III-A	76.4*	-	-	-	-	67.4*	-
I-B	76.4*	-	-	-	-	-	-
III-B	77.6*	-	-	-	-	-	-
IV-B	91.7	90.6	-	-	-	-	-
V-B	79.4*	75.0*	-	85.4	87.8	64.5*	-
I-C	71.5*	68.2*	-	-	-	73.2*	-
I-D	67.4*	80.2	-	48.1*	-	62.3*	-
II-D	81.3	-	-	76.8*	70.£*	60.9*	91.6
III-D	49.9*	-	-	50.8*	57.5*	45.5*	-
I-E	74.5*	-	72.8*	70.4*	-	69.3*	-
II-E	80.8	-	-	-	-	62.3*	93.8
I-F	57.7*	-	-	-	-	49.6*	-
II-F	60.2*	-	-	-	59.0*	58.1*	-

TEACHER COMMENTS

The participating instructors were sent evaluation forms asking for their opinions on the different components in the unit. All of their comments are listed below. A number in parentheses following the statement indicates the number of teachers who made that comment. A copy of the evaluation instrument is included in the appendix.

Safety

All questions should be matching or multiple choice. This test would be hard, but could have rules listed and students would put them in the right classification.
Used the objectives page in part.
Didn't use the transparencies; overhead projector was broken.
I think the questions on the fire extinguishers should be changed. You should tell what kind of fire extinguisher it is and let the students tell what kind of fire it will put out.
Unit was effective in helping students to learn.
Unit was easy for teacher to use.

Orientation to Welding

Not used.
This is a good unit but test question 3 needs to be changed.
Test requires too much writing.

Metals

Unit was effective in helping students to learn; however, there was too much information and it was too technical.
Test and objectives page was too advanced for students; omit objectives 7, 8, 9 and 10.
Suggested activities were unnecessary.
Information sheet was too long.
Used the assignment sheet and answers in part.
The first five objectives are good. The rest are too time-consuming and will very seldom be used in industry.
The students cannot retain all the information.
This is a good unit but it needs more to it.
You need a unit on what rod to use to weld what metals; e.g., ni rod for cast iron. This is what separates the real good welders from the average welders.

VICA

Students memorized the pledge and motto and then recited them. I didn't require the students to write them for the test.
This is a good unit.
I felt the test requires too much writing. The students have problems in this area.

Becoming a Good Leader

I think this is a good unit.

Applying for a Job

Unit was effective in helping students to learn.
Objectives page was motivating.
Suggested activities, assignment sheets, test, and answers were easy for teacher to use.
I think this was a good unit.
Used unit in part; had better materials available.
The objectives page, suggested activities, and transparencies were effective in helping students to learn.
The sample application form is not up to current standards.
The terminology does not cover enough terms.

Measuring

This is one of the better units of the curriculum. It gives the students a basic concept of measuring. However, about 50 percent of my students enroll with very little knowledge on the subject. It takes a lot of practice for them to become proficient.
Unit of instruction was incomplete.
Objectives page and test were complete.
Suggested activities were effective in helping students to learn.
Information sheets were well-sequenced.
Transparencies were easy for teacher to use.
Assignment sheets were incomplete.
Answers to assignment sheets were difficult for teacher to use.
Answers to assignment sheets were unbiased.
Test was thought-provoking.
This unit has too many measuring questions.
Used suggested activities and transparencies in part.
This unit is mostly a refresher unit to help students brush up on their measuring skills. Most students already know how to measure. It does introduce them, maybe, to new measuring tools.
I use a workbook-- Arc Welding, Basic Fundamentals by John R. Walker--mostly for my assignment sheets on this unit. I used all of the assignment sheets on the students for this evaluation plus my workbook.
This unit basically does what it is intended to do and I cannot see that much changing, if any, needs to be done.
There are a couple of measuring tools I wish that were included in this--a curve-o-marker and a wrap-a-round.

There are too many incorrect answers on the answer sheets.
Unit was effective in helping students to learn.
Objectives page was motivating.
Suggested activities, answers to assignment sheets, and answers to test were best available material.
Some of the answers to the assignment sheets are not correct on the measuring part.

Basic Blueprint Reading

Didn't use transparencies.
Unit was effective in helping students to learn.
Information sheets and test were logically written.
Objectives page was thought-provoking and motivating.
Suggested activities, transparencies, and assignment sheets are best available material.
Test and answers were easy for teacher to use.
This unit should be more difficult.
Some of the abbreviations are not used very widely in the welding industry, but are geared more to the machine shop industry.

Oxyacetylene Cutting

Unit is effective in helping students to learn. (2)
Objectives page was complete.
Suggested activities were incomplete.
Test itself was not really difficult. However, it is difficult for a student who cannot read or write very well to write down the correct answer.
Most of the safety, nomenclature, and a lot of the assembly procedure that appears in Unit II should be in Unit I. I usually start on Unit I cutting, but I go over to Unit II for some of the information needed.
Change test to one that can be used with machine-graded answer sheet.
Objectives page was motivating.
Suggested activities, transparencies, and answers to test were easy for teacher to use.
Information was needed for successful employment.
Test was thought-provoking.
On Job Sheet #3, "Lay Out a Pattern on Mild Steel Plate", there is an error on the dimension. The size dimensions cannot be made in the 6" overall.
Unit was incomplete.
Used suggested activities, job sheets, test, and answers in part.
The test in the unit is not too advanced for the students, but is too difficult. I feel that students have a hard time recalling information taught from a book. I think the test should have more matching type questions or multiple-choice. Multiple-choice is more preferable because it gives the students a chance to recall or see the right answer. This will jog their memory a little better.
I combined safety and oxyacetylene cutting on one test and asked only those questions I thought were the most important. I did not

give them all the questions because my students have a hard time recalling information.
The job sheets were unnecessary.
Since this unit comes first in the book, I think there should be something about oxyacetylene regulators put in it.
You need to tell how to set up a cylinder truck.
Since this unit is on cutting, I think there ought to be some information and pictures of cutting equipment like an automatic cutting torch and a pipe beveling machine.
Tell about templates that are available for cutting angles.

Oxyacetylene Fusion Welding

Unit is effective in helping students to learn. (3)
Objectives page, suggested activities, and answers to test are complete.
Test is not really difficult for teacher to use, but it does take too much time.
I use some job sheets, but do other jobs depending on availability of material.
Used objectives page, suggested activities, and job sheets in part. (2)
I believe that information about safety with oxyacetylene cylinders and proper settings for valves should be added. Safety should be stressed more in this unit.
Some of the suggested activities were unnecessary for me.
I have my own procedure for teaching gas welding.
Should add some gas welding job sheets on pipe. These job sheets are incomplete.
Test is probably too hard for most students.
Transparencies--Have adequate or abundant resources.
Answers to test were easy to use.
I think there needs to be a lot more information on the makeup of oxygen and acetylene. Tell how it is made and the danger of its use. There might be a chart on different pressures, different sizes of tips used, and metals. There could be more information about filler rods and their make-up.
Two of my students are special education students. They will not be able to pass any written test, but they are performing satisfactorily on their skill tests.
Unit is up-to-date.
Objectives page is complete and motivating; the student knows what to expect.
Suggested activities page is the best available material.
Information sheet is up-to-date.
I don't have a teacher's guide so I get my test answers from the information sheet.
Transparencies are effective in helping students to learn; they are complete and easy for teacher to use.
Test is complete and up-to-date.
Job sheets are too easy.
This unit is easy to teach and is complete.
Parts of the unit are too easy for the average student.
The job sheets should be combined or completed by the class at the same time.

Oxyacetylene Braze Welding

Effective in helping students to learn. (2)
Objectives page and suggested activities are complete.
Terms and definitions are too advanced for average student to comprehend. It takes a lot of explanation to explain; e.g. coalescence, capillary action, malleability.
For me to use this unit most effectively, I would have to spend more time explaining the information sheets. I do not think the average students can understand most of it themselves.
Have better materials available than the job sheets.
Test is needed for successful employment.
Unit is easy for instructor to use.
Suggested activities, information sheets, and job sheets are incomplete.
All students performed satisfactorily on the job sheet.
I believe the test is too hard. The questions need to be matching, multiple-choice, true-false, or a combination of these. The students can recall more if they see the answer.
Unit should contain more information about sizes of rod, kinds of flux, and how they are made.
Information about welding cast iron and other metals would be helpful.

Shielded Metal Arc Welding

I used job sheets, test, and answers in part. (2)
There are both positive and negative aspects. I use the curriculum as a basis for the students. It is not real motivating. For the students' benefit I use the chalkboard alot, discussion, demonstrations, and individual instruction. I am confident in my technical ability and could do without the curriculum.
The tests take too long to grade. They need to be multiple-choice type questions. You need to develop answer sheets that can be machine graded.
Didn't use transparencies.
Used job sheets in part.
Include more information on code testing.
Test was difficult for teacher to use.
These tests are too time-consuming to grade. We have to read every answer on every paper.

Shielded Metal Arc Welding: Position Welding

Didn't use transparencies.
There are a lot of good, practical work assignments if the instructor would use them. They would produce more well-rounded individuals that could work in several different fields of welding.
Unit was effective in helping students to learn.
Facilities and equipment were readily available.
Lacked available resources such as films, supplementary materials.
I have other materials that I use with curriculum.
Unit is incomplete. (2)

Written in logical order.
Unit is thought-provoking and motivating.
Needed for successful employment in some areas.
Easy for teacher to use.
I am confident of technical knowledge myself.
Didn't use suggested activities.
Used job sheets in part. (2)
You should explain concepts more clearly in information sheet and give examples.
Objectives page, information sheets, and transparencies were effective in helping students to learn.
Suggested activities were too elementary.
Job sheets, test, and answers were incomplete.
Used suggested activities in part.
We need audio visual equipment in the form of slides and tapes. I don't have time to work up these slides.

Gas Tungsten Arc Welding

Didn't use transparencies, job sheets, or assignment sheets.
This is a good unit but it needs to be shorter.
The test questions need to be more in detail; for example, match poor welds with illustrations--this is showing arc (stick) welding steel welds. Question ten is too general. It should be a matching question.
Do away with the demonstrations at the end. Each instructor has to satisfy the local community.

Gas Metal Arc Welding

Didn't use transparencies or job sheets.
Mig machine no longer uses slope control as a setting (manually).
Nothing is said about Innershield.
This unit should have some troubleshooting because this takes up most of the operator's time.
Do away with the demonstrations in the back. Each instructor stresses what is used in the local community.
Easy for teacher to use.
Effective in helping students to learn.
Need more information pertaining to slope and the different processes of mig welding, such as spray arc.
To save time I don't use all of the job sheets. I have my own procedures and steps in letting the students mig weld.
Test is too hard. It needs to have more matching and multiple-choice.
I think this unit could use more information on the makeup of the machines and their behaviors. It should discuss in more detail about slope--slope control, spray arc, dip transfer, and even have some drawings or transparencies on these subjects.

After grading these tests, it looks like I am going to go back over this unit and spend more time because the students have not understood it as well as I thought they had.

The students performed satisfactorily and some performed well on their performance of the job sheets I assigned them.

I have my students start out by welding beads in the flat position on 1/4-inch thick plate. They make a lap joint, tee joint, square butt weld, and V-groove butt weld in the flat position. Then we go to the horizontal position using the same procedure as in the flat position. Then we go to vertical down, vertical up, and overhead.

We do not do any aluminum or stainless steel welding on mig, mainly because of facilities. I believe if a student can weld satisfactorily or better on mild steel, he or she will do the same on these other kinds of metal. We also do pipe welding with the mig machine by rolling the pipe and by welding it in the stationary position.

General Comments

I really believe we need open entry/open exit if we are to satisfy the people.

CONCLUSIONS

This study was designed specifically to identify those concepts on which 20 percent or more of the students were not achieving. This standard was arbitrarily set by the Research Unit. Furthermore, the students' knowledge as related to welding was measured solely by their ability to respond correctly to the test items in the curriculum manual.

On any given test item where fewer than 80 percent of the students responded correctly, we assume there is a problem. It may be that the concept itself is too difficult to understand and that only the more advanced students should be expected to learn it. Unclear information sheets or inadequate assignment sheets and job sheets tend to confuse the student and further restrict their understanding of the material. In many cases, the questions themselves were poorly written. For example, student response was lower on those unit tests composed mainly of short answer and discussion type questions.

When only one or two schools have fewer than 80 percent of the students passing an item, the problem may be unique to that situation. The curriculum materials may provide an adequate base for teaching the concept but are not being used properly by the instructor. Those instructors who are not familiar with the curriculum format might benefit from attending a curriculum utilization workshop. Teachers may not be as knowledgeable in some areas as they are in others. Obviously, they will stress those skills and knowledge with which they feel most comfortable and therefore may have difficulty presenting some topics. No effort was made in this study to ascertain if there was a relationship between the welding instructors' areas of expertise and student achievement or between the instructors' participation in a curriculum workshop and student achievement.

The major conclusion of the Research Unit is that Welding needs to be revised to meet the needs of the instructors and industry. Clear and accurate illustrations or photos should be used. Many of the short answer and discussion type questions should be replaced with multiple-choice, matching, or select-from-a-list questions. More activities should be included in the units to allow the students to practice measuring and drawing objects. The curriculum specialist/writer should determine whether all of the information included in the unit is relevant to the job skills being taught. If the students are satisfactorily completing the skills listed on the job sheets but are not achieving very high scores on the unit test, either the information is unnecessary or the students are not adept in their reading and writing skills.

The Curriculum and Instructional Materials Center is currently developing a slide/tape series based on the job sheets in Welding. Each job sheet is being updated as the slides and script are produced. It is the CIMC's assumption that these supplemental materials will provide a motivational tool to further promote student interest and achievement. It is recommended that future studies be performed to ascertain if indeed these visual aids help raise student achievement in the welding area.

APPENDICES

STUDENT ACHIEVEMENT

This section contains a list of the percentage of correct answers attained by the students overall on each item on the unit tests from the Welding curriculum manual. An asterisk indicates those percents below 80, which are considered by the Research Unit to be less than satisfactory achievement.

Assignment sheets are designated by the letters A.S. Job sheets are designated by the letters J.S. An n.u. beside an item signifies that the item was not used. An n.r. indicates that the instructor did not respond as to whether the job sheet or assignment sheet was used during the course. A g.a. signifies that the assignment sheet or job sheet was done as a group activity.

STUDENT ACHIEVEMENT

Unit I-A	
Q 1a.	93.4
b.	85.7
c.	93.4
Q 2a.	92.3
b.	100
c.	78.0*
d.	80.2
e.	41.8*
f.	54.9*
g.	83.5
Q 3a.	98.9
b.	98.9
c.	97.8
d.	97.8
e.	96.7
Q 4a.	97.8
b.	97.8
c.	97.8
d.	95.6
e.	95.6
f.	86.8
g.	84.6
h.	81.3
Q 5a.	97.8
b.	97.8
c.	96.7
d.	91.2
e.	83.5
Q 6a.	79.1*
b.	81.3
c.	83.5
d.	82.4
Q 7a.	92.3
b.	92.3
c.	87.9
Q 8a.	27.5*
b.	37.4*
c.	51.6*
d.	44.0*
Q 9a.	97.8
b.	97.8
c.	96.7
d.	95.6
e.	95.6
f.	94.5
g.	89.0
h.	89.0
i.	87.9
j.	82.4
Q10.	100 A.S.
Unit II-A	
Q 1a.	66.7*
b.	73.3*
c.	66.7*
d.	66.7*
e.	66.7*
f.	73.3*
Q 2a.	80.0
b.	80.0
Q 3a.	n.u.
b.	n.u.
c.	n.u.
d.	n.u.
e.	n.u.
f.	n.u.
Q 4a.	86.7
b.	66.7*
c.	100
d.	73.3*
Q 5a.	93.3
b.	93.3
c.	86.7
Q 6a.	93.3
b.	93.3
c.	93.3
d.	73.3*
Q 7a.	73.3*
b.	73.3*
Q 8.	86.7
Q 9a.	86.7
b.	86.7
c.	80.0
Q 10.	n.r./A.S.
Q 11.	n.r./A.S.
Unit III-A	
Q 1a.	56.7*
b.	68.7*
c.	73.1*
d.	68.7*
e.	56.7*
f.	70.1*
Q 2a.	97.0
b.	97.0
c.	98.5
d.	94.0
e.	88.1
Q 3a.	98.5

Q 3b.	97.0
c.	91.0
d.	98.5
e.	97.0
f.	80.6
g.	91.0
h.	77.6*
Q 4a.	85.1
b.	79.1*
c.	73.1*
d.	67.2*
Q 5a.	56.7*
b.	53.7*
c.	68.7*
d.	68.7*
Q 6a.	83.6
b.	70.1*
c.	74.6*
d.	82.1
e.	88.1
f.	77.6*
g.	56.7*
h.	85.1
i.	91.0
j.	68.7*
k.	74.6*
l.	83.6
Q 7a.	77.6*
b.	82.1
c.	76.1*
d.	73.1*
Q 8.	55.1*
Q 9.	86.2/n.u.
Q10.	65.3*
Q11a.	71.6*
b.	62.7*
c.	61.2*
d.	55.2*
e.	49.3*
Q12.	59.2*
Q13.	46.4*, n.r./A.S.

Unit I-B

Q 1a.	96.8
b.	90.3
c.	83.9
d.	80.6
e.	67.7*
Q 2.	83.9
Q 3a.	67.7*
b.	61.3*
c.	54.8*
d.	45.2*
Q 4a.	90.3
b.	90.3
c.	87.1
d.	77.4*
Q 5a.	83.9
b.	74.2
c.	83.9
Q 6a.	77.4*
b.	71.0
c.	77.4
d.	83.9
e.	67.7*
f.	61.3*

Unit III-B

Q 1.	47.4*
Q 2a.	94.7
b.	94.7
c.	94.7
d.	73.7*
e.	78.9*
Q 3.	78.9*
Q 4a.	78.9*
b.	89.5
c.	78.9*
d.	63.2*
Q 5a.	94.7
b.	89.5
c.	63.2*
d.	68.4*
e.	52.6*
Q 6.	n.r./A.S.
Q 7.	n.r./A.S.

Unit IV-B

Q 1a.	89.0*
b.	97.3
c.	98.6
d.	87.7
e.	93.2
f.	95.9
Q 2a.	90.4
b.	76.7*
c.	74.0*
d.	64.4*
e.	60.3*
Q 3a.	94.5
b.	89.0
c.	87.7
Q 4a.	79.5*
b.	97.3
c.	95.9
d.	93.2

Q 4e.	94.5
f.	94.5
g.	95.9
h.	95.9
i.	95.9
j.	87.7
Q 5a.	91.8
b.	95.9
c.	93.2
d.	93.2
e.	93.2
f.	97.3
g.	95.9
Q 6a.	94.5
b.	95.9
c.	97.3
d.	97.3
e.	98.6
f.	98.6
g.	97.3
h.	100
i.	97.3
j.	93.2
Q 7a.	76.9*, n.r./A.S.
b.	100, n.r./A.S.
c.	89.5, n.r./A.S.
d.	62.5*, n.r./A.S.
e.	93.3, n.r./A.S.

Unit V-B

Q 1a.	79.2*
b.	85.4
c.	91.7
d.	74.0*
e.	80.2
f.	69.8*
g.	71.9*
Q 2a.	99.0
b.	99.0
c.	99.0
d.	97.9
e.	97.9
Q 3a.	81.3
b.	80.2
c.	84.4
d.	79.2*
e.	76.0*
f.	93.8
g.	92.7
h.	86.5
i.	69.8*
j.	75.0*
k.	68.8*

Q 4a1)	77.6*
2)	39.5*
b1)	60.5*
2)	75.0*
3)	61.8*
4)	71.1*
Q 5a.	73.7*
b.	65.8*
c.	53.9*

Unit V-B

A.S. #1

Q 1a.	91.7
b.	91.7
c.	97.2
d.	97.2
e.	100
f.	91.7
Q 2a.	97.2
b.	91.7
c.	94.4
d.	94.4
e.	94.4
f.	91.7
Q 3a.	97.2
b.	91.7
c.	94.4
d.	94.4
e.	94.4
f.	94.4
Q 4a.	77.8*
b.	77.8*
c.	83.3
d.	83.3

A.S. #2

Q 1a.	93.9
b.	100
Q 2a.	84.8
b.	81.8
Q 3a.	90.9
b.	78.8*
c.	81.8
Q 4a.	84.8
b.	48.5*
c.	84.8
d.	57.6*

A.S. #3

Q 1a.	95.1
b.	97.6
c.	87.8
d.	70.7*

Q 1e.	82.9
Q 2.	56.3*
Q 3.	61.0*
Unit I-C	
Q 1a.	65.6*
b.	80.3
c.	41.0*
d.	42.6*
e.	67.2*
f.	50.8*
g.	45.9*
h.	52.5*
i.	59.0*
Q 2a.	85.2
b.	96.7
Q 3a.	90.2
b.	95.1
c.	77.0*
d.	90.2
e.	88.5
Q 4a.	83.6
b.	75.4*
c.	75.4*
Q 5a.	82.0
b.	78.7*
c.	78.7*
d.	82.0
e.	78.7*
f.	75.4*
Q 6a.	67.2*
b.	54.1*
c.	44.3*
Q 7a.	32.8*
b.	37.7*
c.	37.7*
Q 8a.	90.2
b.	93.4
c.	88.5
Q 9a.	82.0
b.	57.4*
c.	52.5*
d.	63.9*
e.	60.7*
f.	75.4*
g.	57.4*
h.	54.1*
i.	65.6*
j.	49.2*
k.	55.7*
l.	60.7*
Q10a.	96.7
b.	93.4
Q10c.	96.7
d.	96.7
e.	98.4
f.	98.4
g.	63.9*
h.	96.7
i.	98.4
j.	100
k.	96.7
l.	98.4
m.	98.4
n.	96.7
o.	98.4
Q11a.	18.0*
b.	23.0*
c.	16.4*
d.	75.4*
e.	72.1*
Q12.	31.9*
Unit I-C	
A.S #1	
Q 1a.	100
b.	95.7
c.	100
d.	100
Q 2a.	91.3
b.	91.3
c.	78.3*
Q 3a.	60.9*
b.	95.7
c.	100
d1)	100
2)	82.6
3)	69.6*
e1)	91.3
2)	95.7
3)	95.7
A.S. #2	
Q 1.	20.0*
Q 2.	60.0*
Unit I-D	
Q 1a.	86.8
b.	86.8
c.	60.4*
d.	88.7
e.	58.5*
f.	50.9*
g.	52.8*
h.	62.3*
Q 2a.	47.2*

Q 2b.	47.2
c.	52.8*
d.	49.1*
e.	86.8
f.	84.9
g.	83.0
h.	90.6
i.	94.3
j.	58.5*
k.	64.2*
Q 3a.	92.5
b.	90.6
c.	83.0
d.	66.0*
Q 4a.	88.7
b.	88.7
c.	84.9
d.	75.5*
e.	73.6*
Q 5a.	83.0
b.	75.5*
c.	60.4*
d.	41.5*
Q 6.	81.1
Q 7.	79.2*
Q 8a.	54.7*
b.	50.9*
c.	45.3*
d.	47.2*
e.	43.4*
f.	37.7*
g.	39.6*
h.	41.5*
Q 9a.	100, n.r./J.S.
b.	100, n.r./J.S.
c.	100, n.r./J.S.
d.	100, n.r./J.S.
e.	100, n.r./J.S.
f.	100, n.r./J.S.

Unit II-D

Q 1a.	89.7
b.	83.5
c.	89.7
d.	81.4
e.	70.1*
f.	79.4*
Q 2a.	97.9
b.	95.9
c.	94.8
d.	91.8
e.	90.7
f.	86.6
Q 2g.	79.4*
h.	79.4*
i.	79.4*
j.	77.3*
Q 3a.	84.5
b.	85.6
c.	85.6
d.	83.5
e.	96.9
f.	93.8
g.	92.8
h.	92.8
i.	75.3*
j.	82.5
k.	75.3*
l.	80.4
m.	82.5
n.	91.8
o.	97.9
p.	97.9
q.	97.9
Q 4a.	61.9*
b.	56.7*
c.	57.7*
d.	56.7*
e.	49.5*
Q 5a.	85.6
b.	76.3*
c.	76.3*
d.	69.1*
e.	58.8*
Q 6a.	85.6
b.	77.3*
Q 7a.	70.1*
b.	64.9*
Q 8.	84.5
Q 9a.	85.6
b.	84.5
c.	83.5
Q10a.	100, n.r./J.S.
b.	100, n.r./J.S.
c.	100, n.r./J.S.
d.	100, n.r./J.S.
e.	100, n.r./J.S.

Unit III-D

Q 1a.	74.4*
b.	41.9*
c.	58.1*
d.	62.8*
e.	53.5*
Q 2.	34.9*
Q 3a.	60.5*

Q 3b.	48.8*
c.	34.9*
Q 4a.	51.2*
b.	46.5*
c.	25.6*
Q 5a.	14.0*
b.	14.0*
c.	9.3*
d.	7.0*
Q 6.	83.7
Q 7a.	69.8*
b.	69.8*
Q 8a.	67.4*
b.	62.8*
c.	41.9*
d.	20.9*
e.	18.6*
Q 9.	90.7
Q10a.	81.4
b.	81.4
c.	72.1*
Q11.	100, n.r./J.S.

Unit I-E

Q 1a.	84.3
b.	92.8
c.	84.3
d.	84.3
e.	89.2
f.	91.6
g.	86.7
h.	92.8
i.	86.7
j.	96.4
k.	98.8
l.	89.2
m.	81.9
n.	84.3
o.	72.3*
p.	83.1
q.	72.3*
r.	65.1*
s.	97.6
t.	89.2
Q 2a.	85.5
b.	78.3*
c.	73.5*
d.	73.5*
Q 3a.	96.4
b.	96.4
c.	95.2
d.	95.2
e.	95.2
Q 3f.	95.2
g.	88.0
h.	81.9
i.	80.7
j.	62.7*
k.	50.6*
Q 4a.	85.5
b.	80.7
Q 5a.	34.9*
b.	42.2*
c.	66.3*
d.	90.4
Q 6a.	71.1*
b.	51.8*
Q 7.	36.1*
Q 8a.	68.7*
b.	62.7*
c.	56.6*
d.	45.8*
Q 9a.	78.3*
b.	72.3*
c.	67.5*
d.	66.3*
Q10a.	94.0
b.	88.0
c.	98.8
Q11a.	78.3*
b.	97.6
c.	81.9
d.	74.7*
e.	79.5*
f.	77.1*
Q12a.	91.6
b.	75.9*
c.	67.5*
d.	61.4*
Q13a.	73.5*
b.	68.7*
c.	65.1*
d.	50.6*
e.	37.3*
Q14a.	74.7*
b.	69.9*
c.	57.8*
d.	50.6*
Q15a.	67.5*
b.	73.5*
c.	81.9
d.	63.9*
e.	56.6*
f.	41.0*
g.	63.9*
h.	78.3*

Q15i.	55.4*
j.	53.0*
k.	48.2*
l.	51.8*
m.	66.3*
n.	55.4*
o.	44.6*
Q16a.	73.5*
b.	63.9*
c.	78.3*
d.	72.3*
e.	51.8*
Q17a.	90.4
b.	78.3*
c.	88.0
d.	74.7*
e.	90.4
f.	78.3*
g.	84.3
h.	88.0
Q18a.	89.2
b.	61.4*
c.	79.5*
d.	84.3
e.	71.1*
f.	72.3*
g.	75.9*
h.	81.9
i.	86.7
j.	75.9*
k.	80.7
l.	69.9*
Q19a.	89.2
b.	90.4
Q20a.	90.4
b.	88.0
c.	84.3
d.	71.1*
e.	65.1*
Q21a.	51.8*
b.	79.5*
c.	62.7*
d.	69.9*
e.	55.4*
f.	54.2*
Q22a.	100, n.r./J.S.
b.	100, n.r./J.S.
c.	100, n.r./J.S.

Unit I1-E

Q 1a.	82.0
b.	86.9
c.	85.2
Q 1d.	82.0
e.	95.1
f.	90.2
g.	86.9
h.	83.6
i.	88.5
j.	82.0
k.	93.4
l.	83.6
m.	82.0
n.	83.6
o.	88.5
p.	83.6
q.	85.2
Q 2a.	85.2
b.	78.7*
c.	77.0*
d.	73.8*
Q 3a.	95.1
b.	95.1
c.	93.4
d.	95.1
Q 4a.	78.7*
b.	86.9
c.	83.6
d.	95.1
e.	88.5
Q 5a.	88.5
b.	86.9
c.	77.0*
Q 6a.	63.9*
b.	72.1*
c.	62.3*
d.	57.4*
Q 7a.	82.0
b.	75.4*
c.	85.2
d.	82.0
e.	85.2
f.	62.3*
g.	68.9*
Q 8a1)	65.6*
2)	50.8*
b1)	65.6*
2)	67.2*
Q 9a.	75.4*
b.	80.3
c.	75.4*
d.	85.2
e.	78.7*
f.	82.0
Q10a.	100, n.r./J.S.
b.	100, n.r./J.S.

Q10c.	100, n.r./J.S.
d.	100, n.r./J.S.
e.	100, n.r./J.S.
f.	100, n.r./J.S.
g.	u.l., n.r./J.S.
h.	u.l., n.r./J.S.
i.	100, n.r./J.S.
j.	100, n.r./J.S.
k.	100, n.r./J.S.
l.	100, n.r./J.S.
m.	100, n.r./J.S.
n.	u.l., n.r./J.S.

Unit I-F

Q 1a.	95.3
b.	86.0
c.	81.4
d.	86.0
e.	93.0
f.	90.7
g.	86.0
h.	79.1*
i.	83.7
j.	79.1*
k.	81.4
l.	74.4*
m.	83.7
Q 2a.	55.8*
b.	58.1*
c.	48.8*
Q 3a.	74.4*
b.	79.1*
c.	88.4
d.	74.4*
e.	72.1*
f.	76.7*
g.	79.1*
h.	79.1*
i.	67.4*
Q 4a.	60.5*
b.	44.2*
c.	34.9*
d.	46.5*
e.	72.1*
f.	46.5*
g.	27.9*
h.	65.1*
i.	48.8*
j.	74.4*
k.	41.9*
l.	51.2*
m.	55.8*
Q 5a.	76.7*
Q 5b.	74.4*
Q 6a.	72.1*
b.	69.8*
c.	72.1*
d.	69.8*
e.	60.5*
f.	81.4
Q 7a.	60.5*
b.	55.8*
c.	51.2*
Q 8a.	18.6*
b.	11.6*
c.	11.6*
d.	11.6*
Q 9a1)	60.0*
2)	52.0*
3)	32.0*
4)	40.0*
b1)	80.0
2)	80.0
3)	76.0*
4)	88.0
Q 10.	Aluminu
a.	44.2*
b.	37.2*
c.	27.9*
	Stainless
a.	25.6*
b.	20.9*
Q11a.	62.8*
b.	51.2*
c.	53.5*
d.	23.3*
e.	58.1*
Q12a.	74.4*
b.	69.8*
c.	65.1*
d.	48.8*
e.	34.9*
Q13a1)	46.5*
2)	23.3*
3)	23.3*
4)	18.6*
b1)	41.7*
2)	27.8*
3)	16.7*
4)	19.4*
Q14a.	n.r./J.S.
b.	n.r./J.S.
c.	n.r./J.S.
d.	n.r./J.S.
e.	n.r./J.S.
f.	n.r./J.S.

Q14g.	n.r./J.S.
h.	n.r./J.S.
i.	n.r./J.S.
j.	n.r./J.S.
k.	n.r./J.S.
l.	n.r./J.S.
m.	n.r./J.S.
n.	n.r./J.S.
o.	n.r./J.S.
p.	n.r./J.S.

Unit II-F

Q 1a.	16.3*
b.	46.9*
c.	30.6*
d.	65.3*
e.	91.8
f.	46.9*
g.	28.6*
h.	75.5*
i.	77.6*
j.	71.4*
k.	42.9*
l.	34.7*
m.	69.4*
n.	85.7
o.	55.1*
p.	85.7
Q 2a.	77.6*
b.	81.6
c.	65.3*
d.	53.1*
e.	49.0*
f.	36.7*
Q 3a.	81.6
b.	75.5*
c.	75.5*
d.	77.6*
e.	55.1*
f.	63.3*
g.	57.1*
h.	77.6*
i.	59.2*
j.	85.7
k.	77.6*
l.	83.7
m.	69.4*
Q 4a.	87.8
b.	85.7
c.	83.7
d.	77.6*
e.	87.8
Q 5a.	77.6*
Q 5b.	73.5*
c.	51.0*
d.	28.6*
Q 6a.	42.9*
b.	42.9*
Q 7a.	49.0*
b.	40.8*
c.	28.6*
d.	36.7*
e.	26.5*
Q 8a.	51.0*
b.	38.8*
c.	67.3*
d.	59.2*
e.	59.2*
f.	57.1*
g.	87.8
h.	32.7*
i.	69.4*
Q 9a.	85.7
b.	85.7
c.	71.4*
Q10a.	42.9*
b.	34.7*
Q11a.	20.4*
b.	20.4*
Q12a.	100, n.r./J.S.
b.	100, n.r./J.S.
c.	100, n.r./J.S.
d.	100, n.r./J.S.
e.	100, n.r./J.S.
f.	100, n.r./J.S.
g.	n.r., n.u./J.S.
h.	100, n.r./J.S.
i.	n.r., n.u./J.S.
j.	n.r., n.u./J.S.
k.	n.r., n.u./J.S.
l.	100, n.r./J.S.
m.	100, n.r./J.S.
n.	100, n.r./J.S.
o.	n.r., n.u./J.S.
p.	n.r., n.u./J.S.
q.	n.r., n.u./J.S.
r.	n.r., n.u./J.S.
s.	n.r., n.u./J.S.
t.	n.r., n.u./J.S.
u.	n.r., n.u./J.S.

CORRESPONDENCE

This section contains copies of the unit evaluation form and letters which were sent to the welding instructors and their administrators.

OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION
FRANCIS TUTTLE, DIRECTOR • 1515 WEST SIXTH AVE., • STILLWATER, OKLAHOMA 74074 • A.C. (405) 377-2000

September 18, 1979

Dear Vocational Welding Teacher:

Within the next few years, the Curriculum and Instructional Materials Center plans to begin a major revision of the Welding curriculum. Therefore, we are administering a research study to determine what revisions need to be made to ensure that the revised Welding curriculum will be a quality publication.

The Research Coordinating Unit of the State Department of Vocational and Technical Education is in the process of selecting teachers to participate in this research study. Selection of teachers will be partially based on the units that will be taught during the 1979-80 school year and the approximate dates they will be taught.

Enclosed you will find a copy of the Welding table of contents. Please take a few minutes to check the units you will be teaching this year and list the approximate dates you plan to teach each unit. In order to facilitate the research study, we are asking that you return the enclosed table of contents by September 27, 1979. A self-addressed, stamped envelope is provided for your convenience.

Your input in this study is extremely important and necessary for any future revisions. Should you be selected, you may rest assured that the recordkeeping will be minimal. We are looking forward to hearing from you.

Sincerely,

Sheila Stone

Sheila Stone, Assistant Coordinator
Research Coordinating Unit

Bill Litton

Bill Litton, T&I Curriculum Specialist
Curriculum and Instructional Materials Center

Enclosure

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WELDING

Table of Contents

		Approx. Teaching Date
Section A--Introduction		
Unit I	Safety	_____
Unit II	Orientation to Welding	_____
Unit III	Metals	_____
Section B--Related Information		
Unit I	VICA	_____
Unit II	Parliamentary Procedure and Public Speaking	_____
Unit III	Becoming a Good Leader	_____
Unit IV	Applying for a Job	_____
Unit V	Measuring	_____
Section C--Blueprint		
Unit I	Basic Blueprint Reading	_____
Section D--Oxyacetylene Welding		
Unit I	Oxyacetylene Cutting	_____
Unit II	Oxyacetylene Fusion Welding	_____
Unit III	Oxyacetylene Braze Welding	_____
Section E--Arc Welding		
Unit I	Shielded Metal Arc Welding	_____
Unit II	Shielded Metal Arc Welding Position Welding	_____
Section F--Gas Arc Welding		
Unit I	Gas Tungsten Arc Welding	_____
Unit II	Gas Metal Arc Welding	_____

Instructor's Name: _____

School Address: _____

Return to: Sheila Stone, Assistant Coordinator
Research Coordinating Unit
State Department of Vocational and
Technical Education
1515 West Sixth
Stillwater, Oklahoma 74074

OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION
FRANCIS TUTTLE, DIRECTOR • 1515 WEST SIXTH AVE., • STILLWATER, OKLAHOMA 74074 • A.C. (405) 377-2000

October 9, 1979

MEMORANDUM

TO: Area School Administrators and Local Directors

FROM: Sheila Stone, Assistant Coordinator
Research Coordinating Unit

SUBJECT: Field Tests of Curriculum Manuals

The Curriculum and Instructional Materials Center and the Research Coordinating Unit of the State Department of Vocational and Technical Education are conducting field tests of the following curriculum manuals: Welding, Auto Mechanics I, Drafting, Health Services Careers, Nursing I, Family Living, Occupational Child Care, Agriculture Livestock Skills, Vocational Agriculture IV, and Interdisciplinary Cooperative Education. The purpose of these field tests is two-fold: 1) to validate the manuals in terms of student achievement of the performance objectives as stated in the curriculum and 2) to gather input from instructors to use in future revisions of these manuals.

Enclosed please find a copy of the letter which has been sent to all Oklahoma auto mechanics instructors. Similar letters have been sent to instructors using the other nine manuals. Due to an oversight, you were not notified of this project beforehand. We hope this has not caused you any inconvenience. Your support of this project is vital for its success.

We are in the process of selecting teachers for the field tests and would appreciate any encouragement you could give to your instructors to participate. In developing the procedures, we tried to work out a process that would not increase the teacher's workload. The assumption was made that the tests would be administered as they are in the manuals and that these tests would be graded item by item. The information we need on a student is his or her ability to answer a given item correctly. Therefore, we need to obtain the student tests graded to indicate right or wrong answers on each test item. Teachers may add or delete test questions, weight the items for a total score, or use any other procedures they normally use in testing. Each student will be assigned a number by the teacher to be used throughout the field test. The student should write that number in the upper left corner of the test instead of her or his name. Each school will also be assigned a number to be used for identification purposes.

Teachers will be asked to participate on approximately six units. A self-addressed, postage-paid envelope will be provided for each unit. A teacher evaluation form will also be provided for each of the six units. This form should take no more than five or ten minutes to complete and will be invaluable to the Curriculum and Instructional Materials Center in the development and revision of future manuals. A copy of this evaluation form will be sent to you as soon as it is available.

I hope this explanation will give you sufficent information about the project. If you have any questions, please feel free to call me at the State Department.

cc: Regional Administrators

SS/7626/10

15-024-PB

Vo-Tech **memorandum**

REFERENCE	SUBJECT	
	Validation of Welding Manual	
TO	FROM	DATE
	Sheila Stone SS	October 18, 1979

Several weeks ago, we sent you the enclosed letter regarding the field test of the Welding manual. A majority of the instructors have responded. However, we did not receive any information from you. We apologize for this inconvenience, but won't you please take a few minutes to list the approximate dates you will be teaching these units? This information must be obtained before the field test can be conducted.

If you agree to participate in this validation study, you would be asked to send in tests for not more than seven units. The school and the students will be assigned numbers for identification purposes. If you have any questions regarding the study, please feel free to call me at the State Department at 405-377-2000. We would appreciate your participation. Thanks!!

OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION
FRANCIS TUTTLE, DIRECTOR • 1515 WEST SIXTH AVE., • STILLWATER, OKLAHOMA 74074 • A.C. (405) 377-2000

MEMORANDUM

TO:

FROM: Sheila Stone, Assistant Coordinator
Research Coordinating Unit

Thank you for agreeing to participate in the validation of the Welding manual. Without your cooperation, this study could not be done.

In developing the procedures, we tried to work out a process that would not increase your workload. The assumption was made that the tests would be administered as they are in the manuals and that these tests would be graded item by item. The information we need on a student is his or her ability to answer a given item correctly. Therefore, we need to obtain the student tests graded to indicate right or wrong answers on each test item. You may add or delete test questions, weight the items for a total score, or use any other procedures you normally use in testing. We are also asking that you indicate the student's performance on each assignment and job sheet. These performance objectives are listed at the end of each test.

An item by item analysis will be made from all student tests. Those items answered correctly by most of the students will indicate that the items are properly covered in the manual. Those items which the majority of the students answer wrong will indicate specific weaknesses in the manual. The school and students will be assigned numbers for identification purposes; no names will be recorded. All tests and assignment sheets will be returned to you.

A self-addressed, postage-paid envelope will be provided for each unit. The label in the lower corner of the envelope indicates what components of that unit need to be sent to us. In most cases, we require only the tests and completed evaluation form.

The steps to follow for field testing the units are attached for your convenience. We have also included a table of contents that specifies which units you will be validating. Keep these sheets available for future reference.

Thank you again for your cooperation. I would be happy to answer any questions you may have as the field testing progresses. Feel free to call or write to me at any time.

Enc.

STEPS TO FOLLOW WHEN FIELD TESTING UNITS

1. Assign each student a number (between 1 and 99) to be used throughout the field test. The school number and student number should be written in the upper left corner of the first page of the test and on any assignment sheet we may request. Your school number is

2. Teach the unit in your normal manner.

3. Administer the unit test from the curriculum manual.

4. Check (✓) each incorrect item on the test, preferably in red.

5. Mark "OK" on the performance items listed on the test (the assignment sheets and job sheets) that the student has satisfactorily accomplished, check (✓) those that were not performed satisfactorily, and write "NOT USED" or "GROUP ACTIVITY" where applicable.

6. Complete the unit evaluation form. Please be specific in your comments. This is your opportunity to tell what you like or dislike about the unit. We welcome your opinions.

7. Mail tests and unit evaluation form to our office, using our return envelope. We will record the data and mail the tests back to you within one week after we receive them. The evaluation form will be used by the Curriculum and Instructional Materials Center for future revisions.

We would appreciate your participation on the following units. Also, if you have access to any of the unit tests given in August or September, please write the school number and student number on each one and send them in the extra envelope provided. Any inconvenience you may experience now should result in quality curriculum manuals and will benefit all of the programs in the future. Thanks again for helping us.

WELDING

Table of Contents

		You are responsible for:
Section A--Introduction		
Unit I	Safety	_____
Unit II	Orientation to Welding	_____
Unit III	Metals	_____
Section B--Related Information		
Unit I	VICA	_____
Unit II	Parliamentary Procedure and Public Speaking	_____
Unit III	Becoming a Good Leader	_____
Unit IV	Applying for a Job	_____
Unit V	Measuring	_____
Section C--Blueprint		
Unit I	Basic Blueprint Reading	_____
Section D--Oxyacetylene Welding		
Unit I	Oxyacetylene Cutting	_____
Unit II	Oxyacetylene Fusion Welding	_____
Unit III	Oxyacetylene Braze Welding	_____
Section E--Arc Welding		
Unit I	Shielded Metal Arc Welding	_____
Unit II	Shielded Metal Arc Welding Position Welding	_____
Section F--Gas Arc Welding		
Unit I	Gas Tungsten Arc Welding	_____
Unit II	Gas Metal Arc Welding	_____

Instructor's Name: _____

UNIT EVALUATION FORM

School Number_____ Unit Name_____

We need your help? Is the CIMC curriculum material useful in meeting your program objectives? What needs to be improved? How can we improve it? What needs to remain the same?

Did you use:	Please check the appropriate column below: Yes	No	In Part	Directions: Please comment on each component with regard to your major reasons for using or not using that part of the unit. If your reason corresponds with one of the statements on the attached sheet, place the number of the statement in the space provided. Statement Number	OTHER COMMENTS
Unit of Instruction					
Objectives Page					
Suggested Activities					
Information Sheets					
Transparencies					
Assignment Sheets					
Answers to Assignment Sheets					
Job Sheets					
Test					
Answers to Test					

What are the most needed changes in this unit? What suggestions do you have for making the changes?_____

The Oklahoma State Department of Vocational and Technical Education does not discriminate on the basis of race, creed, color, national origin, sex, age, veteran status, qualified handicap or disability.

Examples of Constructive Comments

Note: We need constructive feedback if we are to improve CIMC products. It is very important that we know <u>why</u> something is acceptable or not acceptable.

1. Effective in helping students to learn
2. Ineffective in helping students to learn

3. Facilities and equipment readily available or unnecessary
4. Facilities and equipment unavailable or inappropriate

5. Too elementary for student; too easy
6. Too advanced for student; too difficult

7. Lack available resources (e.g. films, supplementary materials, budget)
8. Have adequate or abundant resources

9. Have better materials available
10. Is the best available material

11. Incomplete
12. Complete

13. Current/up-to-date
14. Out-of-date/behind the times

15. Written in logical order; well-sequenced
16. Not logically written; sequencing poor

17. Thought-provoking
18. Unstimulating/unimaginative

19. Motivating
20. Unmotivating

21. Needed for successful employment
22. Unnecessary

23. Biased/stereotyped
24. Unbiased/not stereotyped

25. Easy for teacher to use
26. Difficult for teacher to use

27. Confident of technical knowledge myself
28. Lack technical knowledge/background/work experience

OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION
FRANCIS TUTTLE, DIRECTOR • 1515 WEST SIXTH AVE., • STILLWATER, OKLAHOMA 74074 • A.C. (405) 377-2000

January 31, 1980

MEMORANDUM

TO:

FROM: Sheila Stone, Assistant Coordinator SS
Research Coordinating Unit

JUST A REMINDER . . . . .

that we still need your cooperation in the Welding field test. This field test is being conducted now so that you will have quality materials for your program in the years to come. Won't you please help us help you???

The steps to follow when field testing the units are listed below. You should have received the return envelopes and unit evaluation forms in the past few months. If you have any questions or comments, please don't hesitate to call me at (405) 377-2000, extension 251. Thank you!!!

1. Assign each student a number (between 1 and 99) to be used throughout the field test. The school number and student number should be written in the upper left corner of the first page of the test and on any assignment sheet we may request. Your school number is _____.

2. Teach the unit in your normal manner.

3. Administer the unit test from the curriculum manual.

4. Check (✓) each incorrect item on the test, preferably in red.

*5. Mark the performance items listed at the end of each test as follows:

   a. Mark "OK" on the performance objectives the student performed satisfactorily.

   b. Check (✓) those items that were not performed satisfactorily.

   c. Write "Not Used" or "Group Activity" where applicable.

6. Complete the unit evaluation form. Please be specific in your comments. This is your opportunity to tell what you like or dislike about the unit. We welcome your opinions.

7. Mail tests and unit evaluation form to our office, using our return envelope. We will record the data and mail the tests back to you within two weeks after we receive them. The evaluation form will be used by the Curriculum and Instructional Materials Center for future revisions.

EQUAL OPPORTUNITY AFFIRMATIVE ACTION EMPLOYER